



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF ENGINEERING & CONSTRUCTION
BUREAU OF DAM SAFETY & FLOOD CONTROL
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JUL 29 2013

Honorable Jonathan Rose
Mayor of Sussex Borough
Municipal Building
2 Main St.
Sussex, NJ 07461-2397

Re: Lake Rutherford Dam (NJDEP Dam File No. 22-315)
Colesville Reservoir Dam (NJDEP Dam File No. 22-254)
Dam Classification Study
2011 Regular Inspection Reports
Operations and Maintenance Manuals (O&M's)

Dear Mayor Rose:

This letter is in reference to the September 2010 Dam Classification Study Addendum submitted by Michael G. Vreeland, P.E., of Guerin & Vreeland Engineering, Inc., for the Lake Rutherford Dam (LRD) and the Colesville Reservoir Dam (CRD) located within the Township of Wantage, Sussex County. This letter is also in reference to the 2011 Regular Inspection Reports and 2010 Operations and Maintenance Manuals (O&M's) submitted by Guerin & Vreeland Engineering, Inc., for both of the above referenced dams.

Upon review of the submitted documents, the Bureau of Dam Safety and Flood Control (Bureau) provides the following comments:

Dam Classification Study:

1. Lake Rutherford Dam (LRD) - In response to the Bureau's previous determination of a Full Probable Maximum Precipitation (PMP) spillway design flood (SDF) for this dam, your engineer indicated that they performed additional incremental analysis and recommend a $\frac{1}{2}$ PMP SDF. However, after review of the HEC-1 and HEC-RAS computer data, it appears that a number of issues with the modeling may be causing reductions in incremental differences between dam breach and non-breach events that were used as a basis for this determination:
 - a. A major issue that appears to be causing incremental difference reductions in the study (particularly for the portions of the study downstream of the confluence of Clove Brook) is a result of timing differences for arrival of the peak flows at the downstream lateral drainage areas. For example, the peak flows during the $\frac{1}{2}$ PMP LRD dam breach and non-

breach scenarios occur at 7.6 hrs and 7.4 hrs respectively – but the peak flow from the Clove Brook tributary occurs at 6.9 hrs. This condition results in HEC-1 obscuring the effects of the LRD dam breach by the influence of lateral flows at Clove Brook (which are significantly greater than both the breach and non-breach from the upstream dams). The program presents the peak flows at each node of the study, and in this case the peak flows are mostly representative of the peak runoff from the Clove Brook tributary (which peaks at an earlier time than those from the upstream dams). Additional lateral drainage areas downstream of the Clove Brook confluence further compound this issue by appearing to show that the flows are converging (even though there is over 10,000 cubic feet per second (cfs) difference in flow between non-breach and breach conditions from the dams). Similar conditions were found to exist for all analyzed storm scenarios.

b. Other issues that appear to be causing problems with the study are related to the HEC-RAS analysis.

- i. Your engineer has performed the HEC-RAS study utilizing a subcritical flow regime throughout. Further review indicates that a mixed flow regime may be necessary given that supercritical flows were found to exist at several downstream cross-sections. Therefore, if only subcritical flow is considered, any cross-sections that should be flowing supercritical are limited to a WSEL equaling the critical depth.
- ii. An unknown error is causing some cross-sections to indicate inconsistent flow depths and Froude numbers. For example, at cross-section 39.05 in the ½ PMP dam breach vs. non-breach run, a flow of 4,118 cfs results in a WSEL of 798.20', channel velocity of 2.35 ft/s, and Froude # of 0.12; 13,402 cfs results in WSEL of 798.18', channel velocity of 7.68 ft/s and Froude #0.40; and a flow of 5,992 cfs results in a WSEL of 800.17', channel velocity of 2.39 ft/s, and Froude # of 0.12. Other cross-sections have similar inconsistencies throughout the study. These inconsistencies may be attributed to one or more of the following additional issues.
- iii. Several cross-sections in the model are shown as overlapping. Cross-sections in HEC-RAS should not overlap and should be drawn perpendicular to the flow lines (typically perpendicular to the contour lines). Please refer to the HEC-RAS guidance documents regarding the proper establishment of cross-sections for the program.
- iv. Vertical boundaries are still being formed at the end of certain cross-sections that do not fully contain the modeled flow depths. Adjustments should be made to the cross-sections to avoid this condition.
- v. There were no adjustments made to any of the default expansion and contraction coefficients used throughout the study. At a minimum, the sections upstream and downstream of the culverts / bridge openings should be modified based on recommended coefficients for these conditions. Other portions of the study may also require modification of these coefficients (i.e. at flow regime transition sections, etc.). Please refer to HEC-RAS guidance documents for use of these coefficients.
- vi. Ineffective flow areas were not utilized throughout the project. Your engineer should review the study and determine if ineffective flow areas are appropriate in some locations.

- vii. The geometry / modeling parameters of the various culverts should be reviewed. (I.e. it appears that in some cases the channel bed does not meet or may overlap the culvert structure.)
2. Colesville Reservoir Dam (CRD) – Given the nature of the submitted analysis, many of the same comments for LRD above apply to the CRD. Therefore, revisions must be made to the entire analysis for these dams prior to making a determination of hazard classification or SDF for the CRD.
3. Previous comments regarding the various danger zones conditions at downstream residences (based on the US Bureau of Reclamation Downstream Hazard Classification Guidelines) must be reevaluated in conjunction with the study revisions noted above.
4. Information must be provided regarding how the critical elevations at structures were determined. Surveyed 1st floor elevations may be necessary for any residences where Sunny Day or incremental impacts are questionable and could impact the appropriate classification and/or SDS designation of either dam.
5. The downstream termination limits must be reevaluated as part of the required analysis revisions noted above. It appears likely that the downstream limits will need to be significantly extended downstream (for LRD) until flows are shown to attenuate either within the downstream channel / floodplain or a large enough body of water.

Lake Rutherford Dam: As part of the extensive review process for these dams, adjustments were made to the study by the Bureau to address some of the issues noted above (lateral hydrograph timing, mixed flow vs. subcritical flow, etc.). It was found that based on the significant impacts to structures and residences, and large incremental differences that exist for all analyzed storm events throughout the downstream study area, that a reduction of the SDS for this dam is unlikely. As such, Bureau has determined that the dam will remain as **Class I (High Hazard) with an approved spillway design flood (SDF) considered to be the flood that results from the Full PMP SDS**. If you or your engineer disagrees with the above, it is recommended that a meeting be held with this office to discuss the basis for this determination. Otherwise, modifications to the existing dam / spillway must be made to allow for the safe passage of the Full PMP SDS of 7,566 cubic feet per second (cfs) of inflow to the lake while providing a minimum of 1 (one) foot of freeboard at the dam as per Dam Safety Standards (N.J.A.C. 7:20 – 1.9 (n)).

Colesville Reservoir Dam: A final determination of the appropriate **hazard classification and SDS cannot yet be made for the CRD**. Based on the necessary study revisions detailed above, the previously approved 24-hour, 100-year storm SDS must be reevaluated at this time in order to determine if this SDS is still appropriate.

A revised study must be submitted to the Bureau addressing the above comments within **4 (four) months** of the date of this letter. The study must include appropriate inundation mapping for LRD and CRD (to be included in the Emergency Action Plan (EAP) documents), and an updated hazard classification and SDS determination for CRD.

2011 Regular Inspection Reports:

Based upon a review of the above-referenced inspection reports, the Lake Rutherford Dam and Colesville Reservoir Dam were both found by your engineer to be in Poor Condition with repairs, maintenance and studies necessary. In addition, the following items must be included with the recommendations of the 2011 Regular Inspection Report:

- 1) For Lake Rutherford Dam:
 - a. In addition to the recommendation for monitoring seepage, a means to quantitatively evaluate the seepage conditions along the downstream toe of the dam must be incorporated into the rehabilitation design for this dam (unless the proposed design adequately addresses the seepage conditions).
 - b. The existing timber bridge over the primary spillway appears to significantly limit flow and has the obvious potential for clogging with debris. Consideration to modifying this bridge and/or providing an emergency spillway should be considered as part of the ongoing studies for this dam.

A number of the recommendations identified in the inspection report are considered to be regular maintenance items and can be completed without a permit from the Bureau. These recommendations (other than tree stump removal for CRD) should be implemented within six (6) months of the date of this letter. Maintenance work such as grass mowing, brush and debris removal, minor concrete repairs, gate maintenance, etc., may be undertaken without prior approval from the Bureau. Please be reminded that your next regular inspection reports for both dams must be submitted by the end of 2013.

New Jersey Dam Safety Compliance Schedule Form:

Based upon a review of the above-mentioned compliance schedule, the Bureau has approved of the schedule and all the submission dates for the items noted. Please be aware, however, that the submittal dates for the tree stump removal procedures for CRD and updates for the interim Emergency Action Plans (EAP's) for both dams have already passed. These overdue items must be submitted **within three (3) months** of the date of this letter. Please note that any deviation from this schedule must be approved by this office.

In view of the above, under the provisions of the Safe Dam Act (N.J.S.A. 58:4-1 et seq.), the Borough of Sussex is hereby ordered to retain the services of a New Jersey licensed professional engineer to perform any necessary studies and to prepare plans and specifications for the implementation of the recommendations as outlined above and in the 2011 inspection report in accordance with the approved compliance schedule. Furthermore, based on the submitted compliance schedule and the Bureau's above designation of Class I (High Hazard) classification and Full PMP SDS for the LRD, a permit application to address any outstanding items necessary to bring the LRD into full compliance with the Dam Safety Standards (N.J.A.C. 7:20) must be submitted within six (6) months of the date of this letter.

Operations and Maintenance Manuals (O&M's):

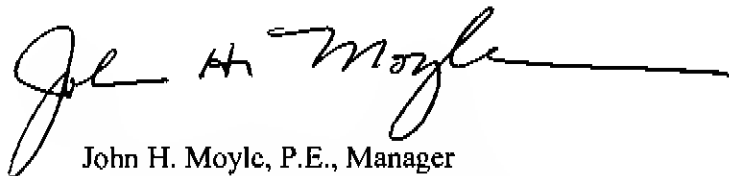
Upon review of the O&M manuals, the Bureau has found the documents to be acceptable as submitted. Please be advised that the proper usage and all required revisions to the O&M are the responsibility of the City of Salem. Also, please be aware that the Bureau must be notified immediately in writing in the case of a transfer of ownership of the dam, and that the manuals must be updated as part of any future rehabilitation of the dams.

Lastly, it appears that the Bureau does not have some of the original design drawings and/or documents for the dams based on drawings included in the EAP documents. Please let this office know if copies of any historical documents are available for review and inclusion in the Bureau files for these dams.

Please note that an application must be filed with this office and a permit issued before any repairs or modifications are undertaken beyond the maintenance items as noted above.

Should you have any questions regarding this matter, please do not hesitate to contact Richard G. Tamagno of this office at (609) 984-0859.

Sincerely,

A handwritten signature in black ink, appearing to read "John H. Moyle", with a long horizontal flourish extending to the right.

John H. Moyle, P.E., Manager
Bureau of Dam Safety & Flood Control

C: Michael G. Vreeland, P.E., Guerin & Vreeland Engineering, Inc.
Wantage Township Engineer & Clerk
Sussex County Engineer